# DR-1 DIGITAL RECORDER
# NOTES ON PB250/DR-1 INTERFACE

PBC 4119

March 1, 1962

# CONTENTS

# DR-1 DIGITAL RECORDER

## A.   SCOPE

This supplement provides detailed information describing modification of the Digital Incremental Recorder, Model 560 R, to permit on-line control by the PB250 Computer.   The modified Digital Incremental Recorder, designated DR-1 Digital Recorder, includes a printed circuit assembly, additional wiring, and associated hardware.   The DR-1 is connected to the PB250 by a cable assembly.

Included in this supplement are a schematic diagram and a logic diagram of the printed circuit assembly, a wiring diagram of the additional chassis wiring and cable assembly, and a list of major parts added.

No additional operation, troubleshooting, or maintenance information is included.   Theory of operation of the printed circuit assembly is described at the logic diagram level.

Programming information for the DR-1 subroutine is included.

## B.   PRINCIPLES OF OPERATION

### B-1.   PB250 INPUTS

The PB250 controls the DR-1 Digital Recorder by PULSE TO SPECI-FIED UNIT commands (PTU commands).   PTU commands are transmitted from receptacle J16 on the PB250 as a combination of signals (L1, L2, L3,

L4, L5) on five output lines and a control pulse (Cpg) on a sixth line (see Figure 1). These signals are transmitted through the cable assembly and supplementary wiring to the CC79 Driver card. The output character gate signal (Cog) and operating voltage inputs to the CC79 Driver card are transmitted from receptacle J3 on the PB250.

Inputs from the PB250 to the CC79 Driver card determine the outputs which control the operation of the DR-1 Digital Recorder. The pen is moved in the X-direction and the Y-direction, placed in contact with the paper, or raised from the paper, by six outputs from the CC79 Driver card.

B-2.    CC79 LOGIC

PTU commands are applied to a set of amplifiers on the CC79 Driver card (see Figure 2). One PTU command causes a true output of the start AND gate, which sets the control flip-flop. The set output of the control flip-flop provides one input to each of two 3-input AND gates. A true output from the travel AND gate permits pen travel in the X-direction or the Y-direction; a true output from the contact AND gate makes it possible to place the pen in contact with the paper or to raise the pen from the paper. An output AND gate is provided for each direction of pen movement (+X, +Y, -X, -Y, pen up, pen down).

When the control flip-flop is in the set state, PTU commands activate of one of the output AND gates when either the travel AND gate or the contact AND gate is activated by the output character gate signal (Cog). The pen can be controlled by PTU commands until a PTU command causes a true output of the stop AND gate. A true output from the stop AND gate resets the control flip-flop, removing the set output from the travel AND gate and the contact AND gate.

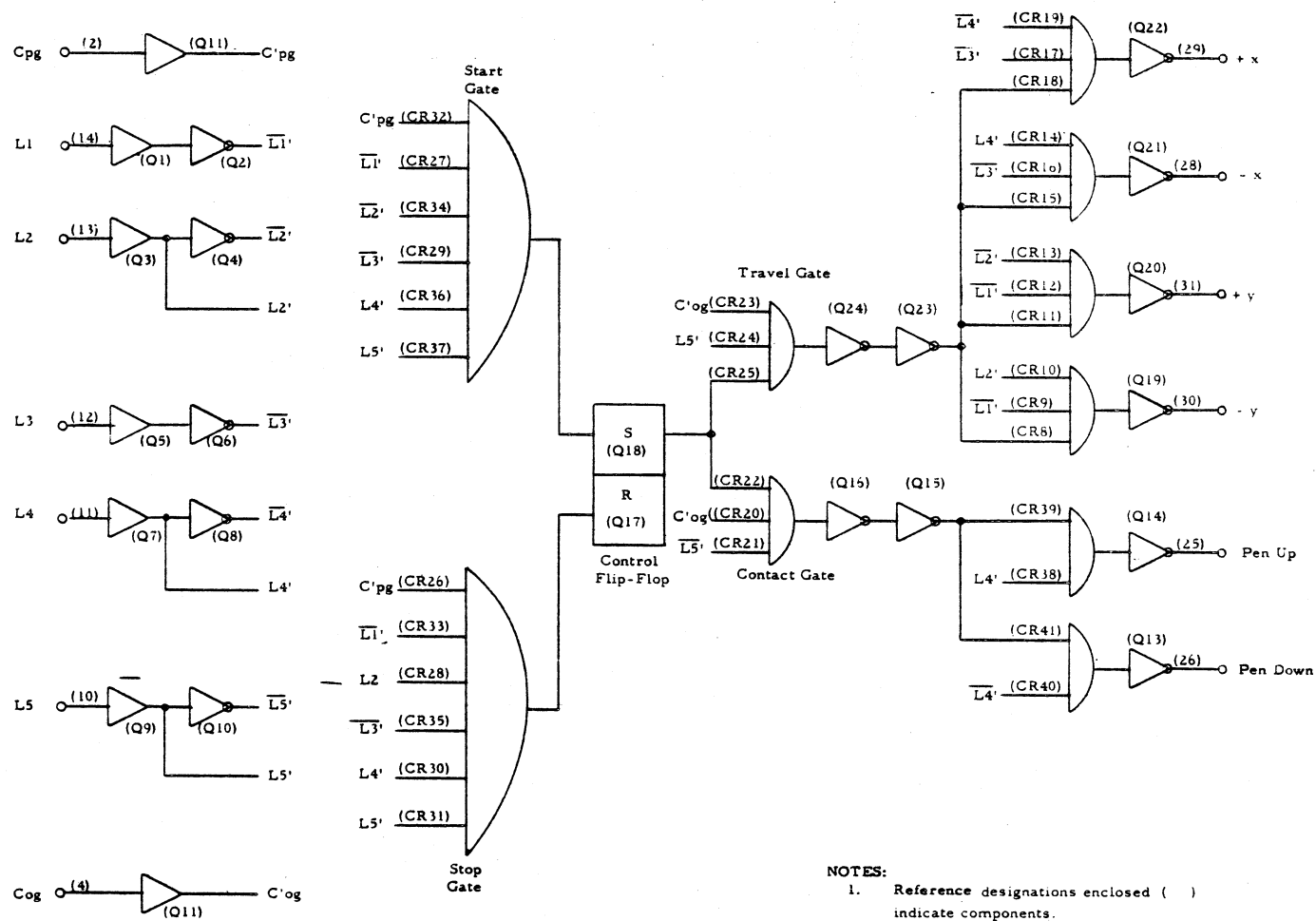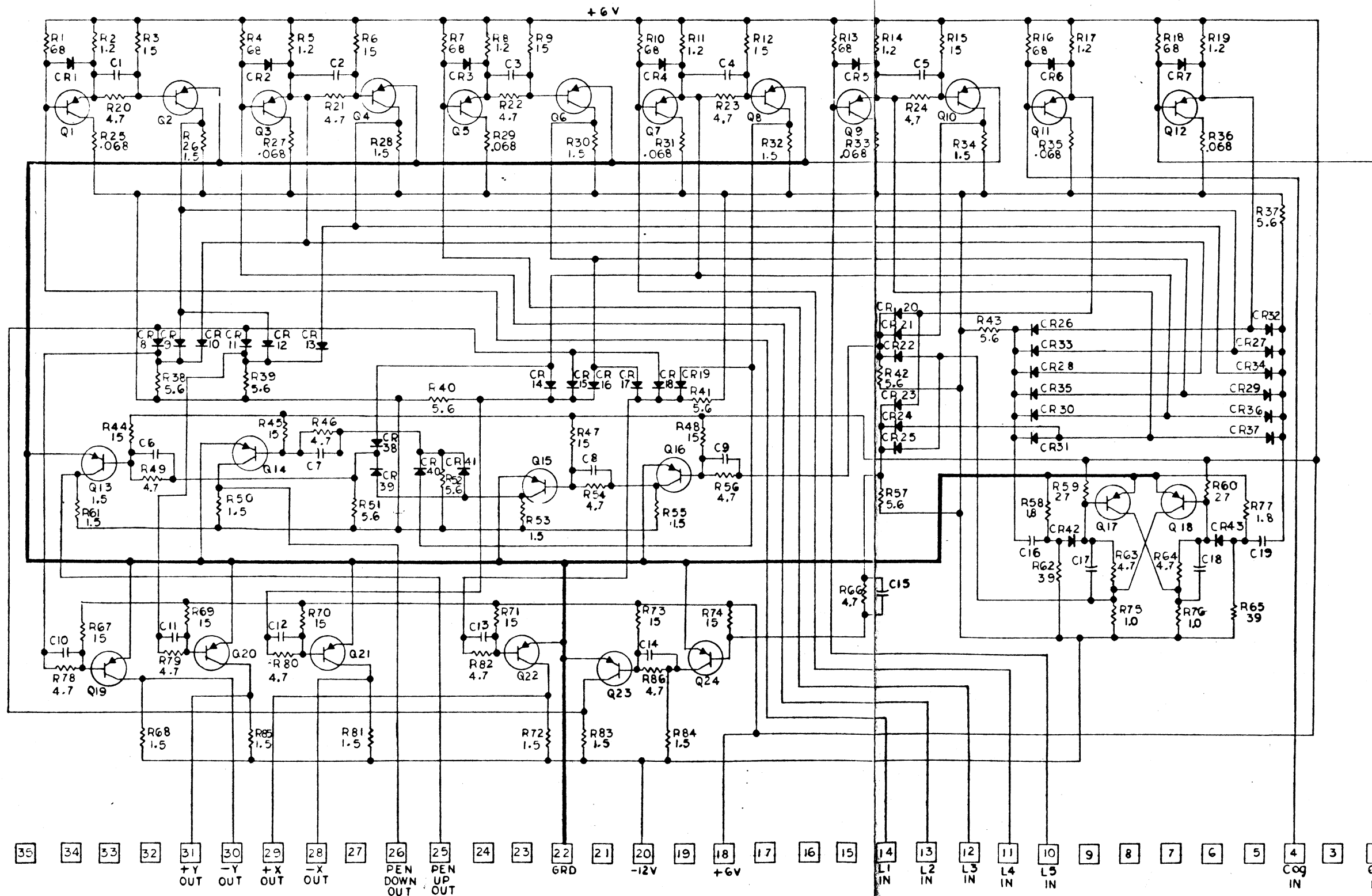Refer to Figure 3 for a schematic diagram of the CC79 Driver card.

PB250 COMPUTER

CABLE ASSEMBLY
(507259)

CC79 DRIVER CARD (506898)

| | J16 | | P16 | | P6 | | J6 | J8 | | P8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cpg | | 12 | | | 10 | | | | 2 | | Cpg |
| L1 | | 4 | | | 1 | | | | 14 | | L1 |
| L2 | | 5 | | | 2 | | | | 13 | | L2 |
| L3 | | 6 | | | 3 | | | | 12 | | L3 |
| L4 | | 7 | | | 4 | | | | 11 | | L4 |
| L5 | | 8 | | | 5 | | | | 10 | | L5 |
| | | | | | 9 | | | | 4 | | Cog |

INPUTS

| | J3 | | P3 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cog | | 12 | | | 7 | | | | 18 | | +6V |
| +6V | | 14 | | | 8 | | | | 20 | | -12V |
| -12V | | 15 | | | 6 | | | | 22 | | GROUND |
| GROUND | | 13 | | | | | | | | | |

P7   J7

7

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | | | 26 | | PEN DOWN |
| 5 | | | 25 | | PEN UP |
| 4 | | | 30 | | -Y |
| 3 | | | 31 | | +Y |
| 2 | | | 28 | | -X |
| 1 | | | 29 | | +X |

OUTPUTS

CABLE ASSEMBLY
(507258)

P5   J5

| | | |
|---|---|---|
| 6 | | +X |
| 5 | | -X |
| 7 | | +Y |
| 8 | | -Y |
| 11 | | PEN UP |
| 12 | | PEN DOWN |
| 15 | | GROUND |

DR-1 DIGITAL RECORDER (509214)

Figure 1. PB250/DR-1 Interface, Schematic Diagram

Figure 2. CC79 Driver Card, Logic Diagram

# ENGINEERING ORDER
## PACKARD BELL COMPUTER CORP

| CCB DWG TO BE CHG PER THIS EO YES___ NO✗ | | |
|---|---|---|

SHEET  1  OF  1

TITLE (DR-1) (CC79) Driver Card  Schematic Diagram

NUMBER  EO 506899

| CHG LTR RES  B | DATE ISSUED 10-29-62 |
|---|---|
| REV | |

| TYPE ORDER | | AFFECTED ENG WORK ORDERS | NEXT ASSEMBLY | DISPOSITION OF PARTS |
|---|---|---|---|---|
| CHG ✗ | VAR | | | ✗ M/C DISP  ___ USE AS IS |
| STOP | RELEASE | DRAWING LIST NUMBERS | MODEL NUMBERS DR-1 | ___ SCRAP  ___ REWORK<br>___ NONE ON HAND |

| SIGNATURES | DATE | SERIAL EFFECTIVITY: MFG ALL NEW LOTS | EFFECT ON COST |
|---|---|---|---|
| Robert Stark | 10-15-62 | CUST SERV  ———— | ___ INCREASE  ___ DECREASE |
| Hampton | 10/25/62 | | ✗ NONE |
| Eng Mgr | 10/21/2 | | |
| CCB Donald Jones | 10-26-62 | | |

REASON FOR CHANGE
___ CUSTOMER REQUEST     ✗ DESIGN IMPROVEMENT
___ REC COST RECOVERY    ___ VENDOR REQUEST
___ REC NO COST RECOVERY ___ ENG ERROR
___ PROD REQUEST         ___ SPECIFICATION REQ
                         ___ COST REDUCTION

COORD / W EO NO.S

DESCRIPTION

Change Notes to read:

2. All transistors PBC 503748 (2N1305)

~~All diodes PBC 503051 (May be replaced by 1N770)~~

| ITEM | QTY | PART NO. & DESCRIPTION | ITEM | QTY | PART NO. & DESCRIPTION | PART DISP |
|---|---|---|---|---|---|---|
| | | IS | | | WAS | |

MATERIAL LIST REVISIONS

PBCC 124 B

**REFERENCE DESIGNATIONS**

| FIRST | LAST | DELETED |
|-------|------|---------|
| C1    | C19  |         |
| CR1   | CR43 |         |
| Q1    | Q24  |         |
| R1    | R86  |         |

| BL. | E.O. NO. | REV LTR | REVISION | CHG BY | DATE | APP |
|-----|----------|---------|----------|--------|------|-----|
| -   | —        | A       | RELEASE (PER EDR 39...) |  | 11-6 |  |

NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL DIODES: PBC STANDARD PART NO. 503050 (HUGHES HD2935).

2. ALL TRANSISTORS: PBC STANDARD PART NO. ~~503004~~ (RAYTHEON 2N414). 503798 — 2N1305

3. ALL RESISTOR VALUES IN KILOHMS, ±5%, 1/4 W.

4. ALL CAPACITOR VALUES ARE 500 UUF ±10%.

506899 | A

PHOTOREDUCTION NOT TO SCALE

Terminal designations (bottom):
35 34 33 32 31(+Y OUT) 30(-Y OUT) 29(+X OUT) 28(-X OUT) 27 26(PEN DOWN OUT) 25(PEN UP OUT) 24 23 22(GRD) 21 20(-12V) 19 18(+6V) 17 16 15 14(L1 IN) 13(L2 IN) 12(L3 IN) 11(L4 IN) 10(L5 IN) 9 8 7 6 5 4(Cog IN) 3 2(Epg IN) 1

| MATL | BASIC MODEL | DR-1 | SCALE | NOTES: UNLESS OTHERWISE NOTED |
|------|-------------|------|-------|---------|
| FINISH | NEXT ASSY | 506898 | REF |  |

PACKARD BELL COMPUTER CORP.
LOS ANGELES 25, CALIFORNIA

SCHEMATIC DIAGRAM, DRIVER CARD (DR-1) (CC 79)

A

Figure 3. CC79 Driver Card, Schematic Diagram

C.    PARTS LIST

A parts list for the DR-1 Digital Recorder is provided in Table 1 and illustrated in Figure 4.

Table 1.

DR-1 DIGITAL RECORDER, MAJOR COMPONENTS

| Part Description | PBCC Part Number | Qty |
|---|---|---|
| DR-1 DIGITAL RECORDER | 509214 | 1 |
| RECORDER, Model 560 R | 509219 | 1 |
| BASE, Mounting, Plotter | 507236 | 1 |
| WIRING ASSY, Printed | 506898 | 1 |
| CONNECTOR, Miniature | 503166-25-1 | 2 |
| CONNECTOR, 35-Pin | 503019-1 | 1 |
| CABLE ASSY | 507258 | 1 |
| CABLE ASSY | 507259 | 1 |

D.    PROGRAMMING

Control subroutine programming information is presented in Table 2. Flow diagrams are presented in Figure 5. For explanation of notation, refer to Programming Manual (PBC 1004).
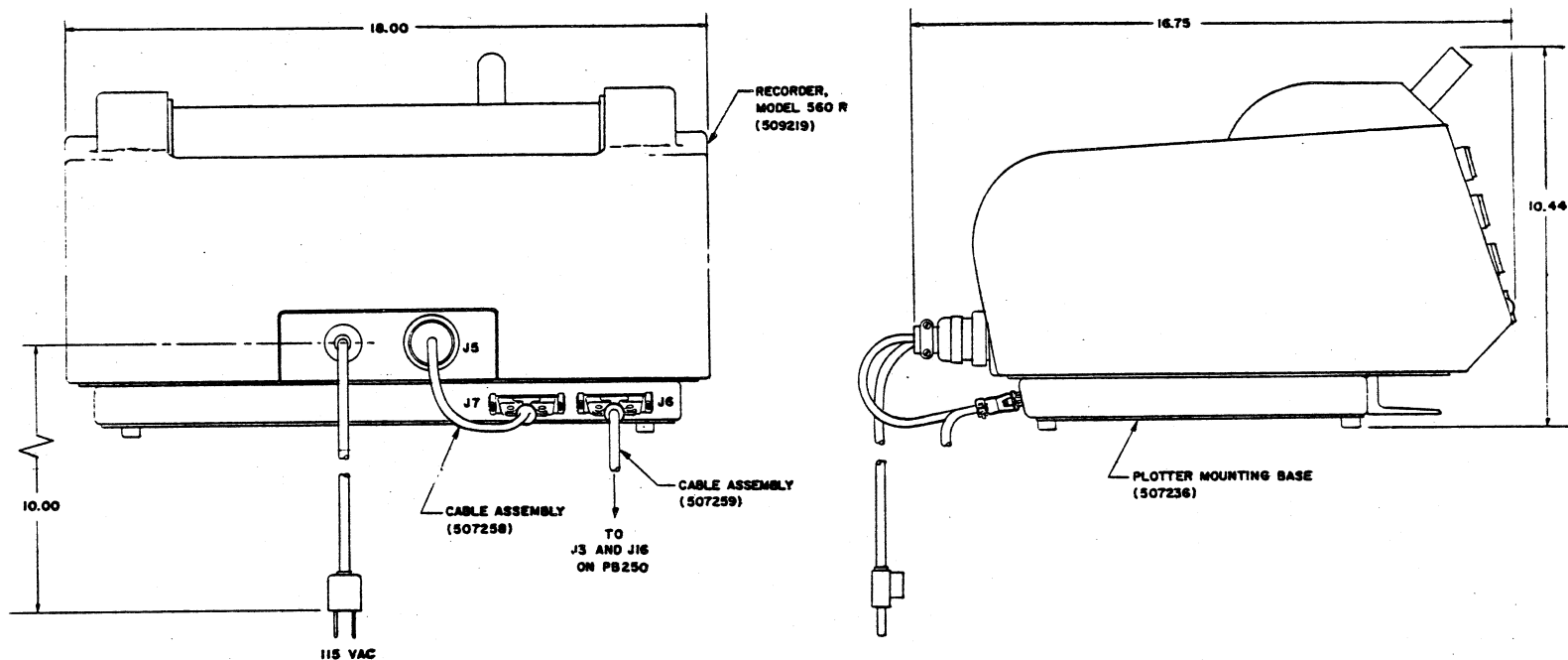
Figure 4. DR-1 Digital Recorder, Major Components

Table 2. (Sheet 1 of 12)

## DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| | |
|---|---|
| Purpose: | To provide on-line control of the DR-1 Digital Recorder pen and drum. |
| Storage: | The subroutine is relocatable and occupies one long line with the exception of sectors 231-234, 354-357 and 373-376. |
| Timing: | Output proceeds at approximately 200 steps per second for a continuous graph. When plotting points spaced at 1/2 inch, output proceeds at approximately 75 points per minute. |
| Use: | |
| Calling Sequence | The calling sequence for the subroutine is as follows: |

| | | |
|---|---|---|
| | LDA | number of increments of 1/100 inch in the X direction, negative numbers in two's complement form, Q = 21 |
| | LDB | number of increments of 1/100 inch in the Y direction, negative numbers in two's complement form, Q = 21 |
| | LDC | (See Return Command) |
| | TRU | entry |

Entry is 000LL, where LL is the line location of the subroutine.

| | |
|---|---|
| Return Command | The return command determines the mode of plotting as follows: |

Table 2.   (Sheet 2 of 12)

DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

Return Command

(Continued)

    a.    A sequence-tagged TCN command to lower the pen, plot to the point $(X_0, Y_0)$ and exit to the main program.

    b.    A sequence-tagged TAN command to lower the pen, plot to the point $(X_0, Y_0)$, mark the point, and exit to the main program.

    c.    A sequenced-tagged TBN command to raise the pen, and, upon reaching the point $(X_0, Y_0)$, exit to the main program.

    d.    A TRU command to raise the pen and, upon reaching the point $(X_0, Y_0,)$ lower the pen, mark the point and exit to the main program.

    e.    A sequence-tagged TOF command to set the pen location counter to (0, 0) and exit to the main program.

Exit

    Upon returning to the main program, the contents of the A and B registers contain $X_0$ and $Y_0$ respectively.

Method:

A PTU command with line number of 30 is used to enable the plotter.  The WOC commands controlling the movement of the pen and drum are as follows:

| | |
|---|---|
| SSS WOC 10 | to raise the pen |
| SSS WOC 00 | to lower the pen |
| SSS WOC 21 | to step + X |
| SSS WOC 31 | to step - X |

Table 2. (Sheet 3 of 12)

## DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

Method:

(continued)

SSS WOC 24    to step + Y
SSS WOC 26    to step - Y
SSS WOC 20    to step + X + Y
SSS WOC 30    to step - X + Y
SSS WOC 22    to step + X - Y
SSS WOC 32    to step - X - Y

A PTU with line number 32 is used to disable the plotter.

The subroutine determines the number of steps required to move the pen from its present location to the location supplied by the main program as follows:

$$X_0 - X_1 = X_2$$

$$Y_0 - Y_1 = Y_2$$

The movement of the pen and drum is divided into three stages, enabling the approximate line to be plotted as close as possible to the desired line.

Table 2. (Sheet 4 of 12)

## DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | | REMARKS |
|---|---|---|---|---|
| 00007$ | 001S1307; | STD | 1 | Save $(X_0, Y_0)$ |
| 001 | +0000000 | | 2 | $Y_0$ |
| 002 | +0000000 | | 3 | $X_0$ |
| 003 | 004S1007; | STC | 4 | |
| 004 | +0000000 | [Exit] | 5 | |
| 005 | 006S0200; | IBC | 6 | |
| 006 | 036S7030; | PTU | 16 | Enable plotter |
| 007 | 021S2110; | SLT | 7 | 9 |
| 010 | 011S1307; | STD | | Pen location ⟶ location counter |
| 011 | +0000000 | | | $Y_1$ |
| 012 | +0000000 | | | $X_1$ |
| 013 | 004S3707; | TRU | | ⟶ exit |
| 014 | 252 0000; | Const | | Sector decrement |
| 015 | 117S1107; | STA | | I WOC ⟶ (11707) |
| 016 | +0000001 | Const | | |
| 017 | 363 1107; | STA | | T – 1 ⟶ (36307) |
| 020 | 235S3707; | TRU | | |
| 021 | 171 3607; | TBN | 8 | ⟶ Set location counter to (0,0) |
| 022 | 027S2110; | SLT | 9 | 4 |
| 023 | 250 0507; | LDA | | |
| 024 | 153 1507; | SUB | | |
| 025 | 075 3507; | TAN | | Delay |
| 026 | 024S3707; | TRU | | |
| 027 | 033 3607; | TBN | 10 | ⟶ Raise pen |
| 030 | 031S0507; | LDA | 11 | |
| 031 | 224S6000; | WOC | 12 | Pen down |
| 032 | 036S1107; | STA | 13 | |
| 033 | 034S0507; | LDA | | |
| 034 | 224S6010; | WOC | | Pen up |
| 035 | 036S1107; | STA | | |

Table 2. (Sheet 5 of 12)

# DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | | REMARKS |
|---|---|---|---|---|
| 036 | +0000000 | WOC | 14 17 | |
| 037 | 005S4400; | CLC | 15 | |
| 040 | 046 0507; | LDA | | Mark flag $\longrightarrow$ (A) |
| 041 | 065 3507; | TAN | | |
| 042 | 246S7032; | PTU | | Disable plotter |
| 043 | 045S2110; | SLT | 23 | 1 |
| 044 | 053S4500; | CLA | | |
| 045 | 046S1207; | STB | 24 | |
| 046 | +0000000 | | | Mark flag |
| 047 | 001 0707; | LDP | 25 | $(X_0, Y_0) \longrightarrow (AB)$ |
| 050 | 012 1507; | SUB | 26 | $X_0 - X_1$ |
| 051 | 052S1107; | STA | 27 | |
| 052 | +0000000 | | | $\pm X_2$ |
| 053 | 054S0300; | ROT | 28 | |
| 054 | 060 1507; | SUB | | |
| 055 | 061S4300; | CLB | | |
| 056 | 011 1507; | SUB | 29 | $Y_0 - Y_1$ |
| 057 | 060S1107; | STA | 30 | |
| 060 | +0000000 | | | $\pm Y_2$ |
| 061 | 044 3507; | TAN | 31 | $\longrightarrow |Y_2|$ |
| 062 | 064 3407; | TCN | 32 | $\longrightarrow |X_2|$ |
| 063 | 070S0100; | IAC | 33 | |
| 064 | 065S0100; | IAC | | |
| 065 | 066S4400; | CLC | 34 | |
| 066 | 067S4500; | CLA | | |
| 067 | 023S6000; | WOC | 36 | Pen down for mark |
| 070 | 052 1507; | SUB | | |
| 071 | 072S5607; | CAM | | $|X_2|$ : zero |
| 072 | +0000000 | Const | | |
| 073 | 145 7507; | TOF | | To WOC Y only |

Table 2. (Sheet 6 of 12)

# DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | REMARKS |
|---|---|---|---|
| 074 | 075S0100; | IAC | |
| 075 | 175S0407; | LDC | $4.0$ |
| 076 | 077S5607; | CAM | $\mid Y_2 \mid$ : zero |
| 077 | +0000000 | Const | |
| 100 | 140 7507; | TOF | To WOC X only |
| 101 | 102S1107; | STA | |
| 102 | +0000000 | | $\mid Y_2 \mid$ |
| 103 | 104S1007; | STC | |
| 104 | +0000000 | | $\mid X_2 \mid$ |
| 105 | 104 1507; | SUB | $\mid Y_2 \mid - \mid X_2 \mid$ |
| 106 | 107S1107; | STA | |
| 107 | +0000000 | | Greater flag |
| 110 | 113 3507; | TAN | $\mid X_2 \mid > \mid Y_2 \mid$ |
| 111 | 102 0507; | LDA | $\mid X_2 \mid < \mid Y_2 \mid$ |
| 112 | 113S0100; | IAC | |
| 113 | 102 0507; | LDA | |
| 114 | 115S4300; | CLB | |
| 115 | +0000000 | | P |
| 116 | 117S0300; | ROT | |
| 117 | +0000000 | WOC | I WOC |
| 120 | 044S1207; | STB | 244 |
| 121 | 122S1207; | STB | |
| 122 | +0000000 | | Large coordinate |
| 123 | 236 1007; | STC | Small coordinate ⟶ (23607) |
| 124 | 126S2110; | SLT | 1 |
| 125 | 127S1407; | ADD | (A) + 1 |
| 126 | 155S3100; | DIV | $L_c / S_c$ |
| 127 | +0000001 | Const | |
| 130 | 115 5607; | CAM | (A) :    P |
| 131 | 133 7507; | TOF | |

Table 2. (Sheet 7 of 12)

# DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | REMARKS |
|---|---|---|---|
| 132 | 116S4400; | CLC | To I WOC |
| 133 | 334 0507; | LDA | |
| 134 | 135S1507; | SUB | I - 1 |
| 135 | +0000001 | Const | |
| 136 | 334 1107; | STA | I - 1 ——▶ (33407) |
| 137 | 15050300; | ROT | |
| 140 | 334 1007; | STC | Coordinate to I |
| 141 | 142S0607; | LDB | |
| 142 | +0000001 | Const | |
| 143 | 115 1207; | STB | 1 ——▶ P |
| 144 | 312S3707; | TRU | To select WOC |
| 145 | 334 1007; | STC | Coordinate ——▶ I |
| 146 | 147S0607; | LDB | |
| 147 | +0000001 | Const | |
| 150 | 115 1207; | STB | 1 ——▶ P |
| 151 | 261S3707; | TRU | To select WOC |
| 152 | 153S1407; | ADD | E/O + 1 |
| 153 | +0000001 | | |
| 154 | 162S4400; | CLC | |
| 155 | 115 1207; | STB | |
| 156 | 122 0507; | LDA | $L_c$ ——▶ (A) |
| 157 | 236 1507; | SUB | $L_c$ - $S_c$ |
| 160 | 161S1107; | STA | |
| 161 | +0000000 | | D |
| 162 | 163S4400; | CLC | |
| 163 | 164S0000; | NIAC | (A) copied to (C) |
| 164 | 165S0100; | IAC | |
| 165 | 166S4100; | GTB | |
| 166 | 167S0200; | IBC | |
| 167 | 172S0200; | IBC | E/O counter ——▶(B) |

Table 2. (Sheet 8 of 12)

# DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | REMARKS |
|---|---|---|---|
| 170 | 172S2110; | SLT | 1 |
| 171 | 367S4500; | CLA | |
| 172 | 221S3100; | DIV | D/P |
| 173 | 235 3507; | TAN | Odd pass |
| 174 | 362S3707; | TRU | Even pass |
| 175 | +0000021 | Const | Mark terminator |
| 176 | 177S0607; | LDB | 41 |
| 177 | +1111100 | Const | Mark constant |
| 200 | 207 0507; | LDA | 42 To save WOC table |
| 201 | 210S2507; | IAM | 43 |
| 202 | 212S6024; | WOC | + Y |
| 203 | 212S6022; | WOC | + X - Y |
| 204 | 212S6032; | WOC | - X - Y |
| 205 | 212S6030; | WOC | - X + Y |
| 206 | 212S6020; | WOC | + X + Y |
| 207 | 212S6026; | WOC | - Y |
| 210 | 215 1107; | STA | 44 |
| 211 | 212S0100; | IAC | 45 Terminator ——▶(C) |
| 212 | 213S0100; | IAC | 48 |
| 213 | 214S4400; | CLC | 46 |
| 214 | 216S2100; | LSD | 47 1 |
| 215 | +0000000 | [WOC] | 47 |
| 216 | 200 3607; | TBN | 50 To change WOC |
| 217 | 042 3407; | TCN | 51 Point marked |
| 220 | 212S0100; | IAC | 52 |
| 221 | 334 1207; | STB | I ——▶(33407) |
| 222 | 115 0407; | LDC | P ——▶ C |
| 223 | 253S3200; | MUP | (I)    (P) |
| 224 | 225S0507; | LDA | 18 |
| 225 | +0000015 | Const | |

Table 2. (Sheet 9 of 12)

# DR-1 DIGITAL RECORDER CONTROL SUBROUTINE
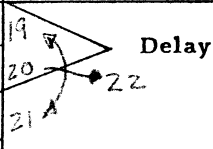
| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | REMARKS |
|---|---|---|---|
| 226 | 016 1507; | SUB | Delay |
| 227 | 043 3507; | TAN | |
| 230 | 226S3707; | TRU | |
| 23507$ | 236S0507; | LDA | |
| 236 | +0000000 | | $S_c$ |
| 237 | 240S5607; | CAM | $S_c$: zero |
| 240 | +0000000 | Const | |
| 241 | 333 7507; | TOF | |
| 242 | 243S4400; | CLC | |
| 243 | +0000000 | Const | |
| 244 | +0000000 | [WOC] | $S_c$ WOC |
| 245 | 361S0607; | LDB | E/O counter ⟶ (B) |
| 246 | 001 0707; | LDP | $(X_0, Y_0)$ ⟶ (A B) |
| 247 | 010S3707; | TRU | |
| 250 | +0000034 | Const | |
| 251 | 331S1507; | SUB | $S_c - 1$ |
| 252 | +0000000 | | (I P) |
| 253 | 252 1207; | STB | |
| 254 | 161 0507; | LDA | D ⟶ (A) |
| 255 | 252 1507; | SUB | D - (I P) |
| 256 | 363 1107; | STA | T ⟶ (36307) |
| 257 | 107 0507; | LDA | Greater flag |
| 260 | 312 3507; | TAN | |
| 261 | 060 0507; | LDA | $\pm Y_2$ ⟶ (A) |
| 262 | 266 3507; | TAN | |
| 263 | 264S0507; | LDA | |
| 264 | 377S6024; | WOC | WOC + Y |
| 265 | 267S4400; | CLC | |
| 266 | 267S0507; | LDA | |
| 267 | 377S6026; | WOC | WOC - Y |

Table 2. (Sheet 10 of 12)

# DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | REMARKS |
|---|---|---|---|
| 270 | 271S5607; | CAM | |
| 271 | 377S6024; | Const | |
| 272 | 052 0607; | LDB | $\pm X_2 \longrightarrow (B)$ |
| 273 | 303 7507; | TOF | |
| 274 | 300 3607; | TBN | $\longrightarrow - X - Y$ |
| 275 | 276S0607; | LDB | |
| 276 | 251S6022; | WOC | WOC + X - Y |
| 277 | 357S4400; | CLC | |
| 300 | 301S0607; | LDB | |
| 301 | 251S6032; | WOC | WOC - X - Y |
| 302 | 357S4400; | CLC | |
| 303 | 307 3607; | TBN | $\longrightarrow X + Y$ |
| 304 | 305S0607; | LDB | |
| 305 | 251S6020; | WOC | WOC + X + Y |
| 306 | 357S4400; | CLC | |
| 307 | 310S0607; | LDB | |
| 310 | 251S6030; | WOC | - X + Y |
| 311 | 357S4400; | CLC | |
| 312 | 052 0507; | LDA | $\pm X_2 \longrightarrow (A)$ |
| 313 | 317 3507; | TAN | |
| 314 | 315S0507; | LDA | |
| 315 | 377S6021; | WOC | WOC + X |
| 316 | 320S4400; | CLC | |
| 317 | 320S0507; | LDA | |
| 320 | 377S6031; | WOC | WOC - X |
| 321 | 322S5607; | CAM | |
| 322 | 377S6021; | Const | |
| 323 | 060 0607; | LDB | $\pm Y_2$ |
| 324 | 327 7507; | TOF | |
| 325 | 300 3607; | TBN | |

Table 2. (Sheet 11 of 12)

## DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | REMARKS |
|----------|-------------|------------------|---------|
| 326 | 310S0607; | LDB | ⟶ - X + Y |
| 327 | 275 3607; | TBN | |
| 330 | 305S0607; | LDB | ⟶ + X + Y |
| 331 | +0000001 | Const | |
| 332 | 236 1107; | STA | $S_c$ - 1 ⟶ (23607) |
| 333 | 334S0507; | LDA | |
| 334 | +0000000 | | I |
| 335 | 336S5607; | CAM | I: zero |
| 336 | +0000000 | Const | |
| 337 | 341 7507; | TOF | |
| 340 | 352S4400; | CLC | |
| 341 | 363 0507; | LDA | T : zero |
| 342 | 343S5607; | CAM | |
| 343 | +0000000 | Const | |
| 344 | 346 7507; | TOF | |
| 345 | 361S4500; | CLA | |
| 346 | 236 0507; | LDA | |
| 347 | 350S5607; | CAM | $S_c$ : zero's |
| 350 | +0000000 | Const | |
| 351 | 040 7507; | TOF | |
| 352 | 234S4500; | CLA | |
| 353 | 116S4500; | CLA | 0's ⟶ (A) |
| 36007$ | 371S1107; | STA | |
| 361 | +0000000 | Const | |
| 362 | 363S0507; | LDA | |
| 363 | +0000000 | | T |
| 364 | 365S5607; | CAM | T : 0 |
| 365 | +0000000 | Const | |
| 366 | 235 7507; | TOF | |
| 367 | 370S4400; | CLC | |

Table 2. (Sheet 12 of 12)

## DR-1 DIGITAL RECORDER CONTROL SUBROUTINE

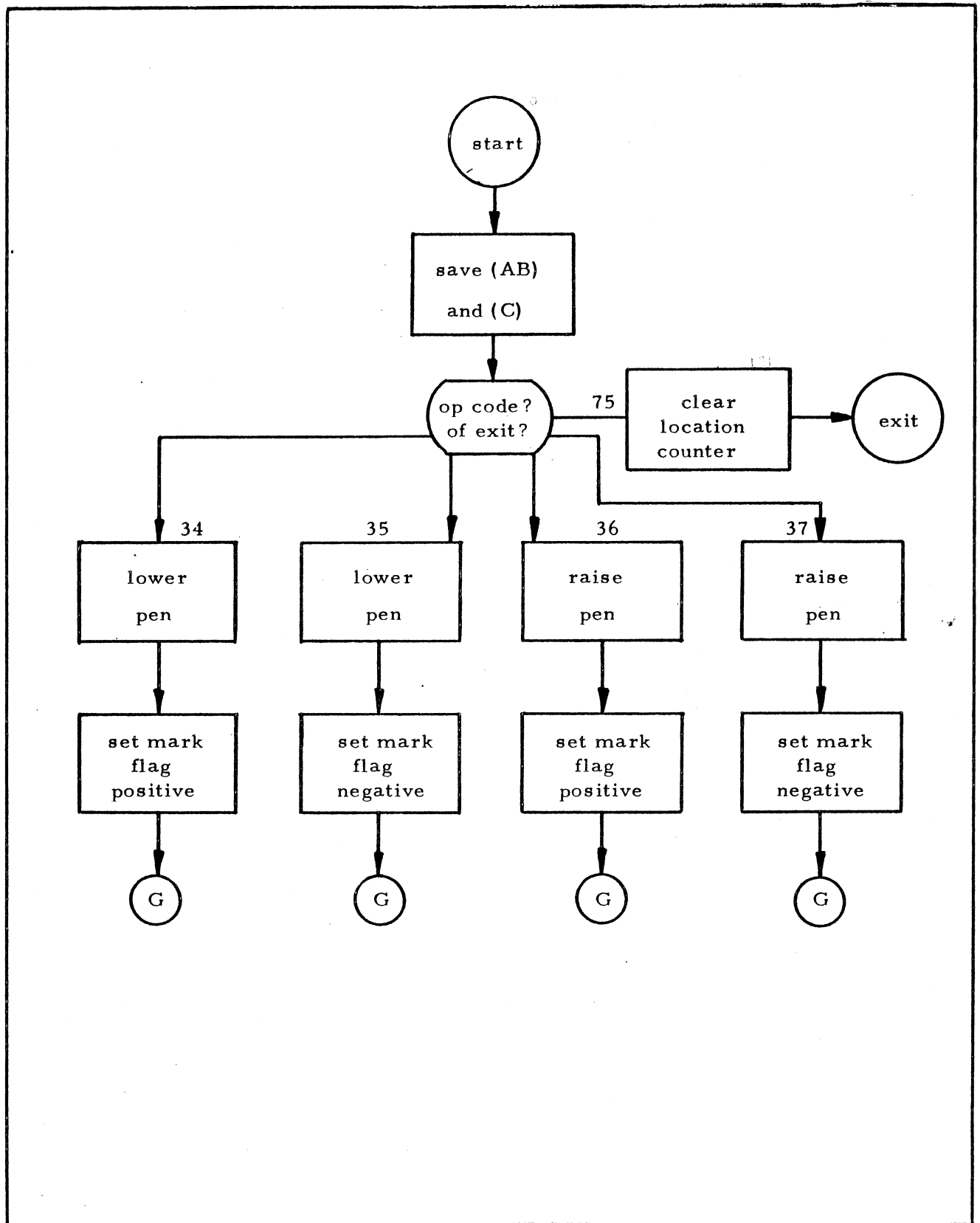| LOCATION | INSTRUCTION | SYMBOLIC OP CODE | REMARKS |
|---|---|---|---|
| 370 | 007S4300; | CLB | |
| 371 | +0000000 | | T WOC |
| 372 | 014S1507; | SUB | |
| 37707$ | 016S1507; | SUB | WOC - sector decrement |
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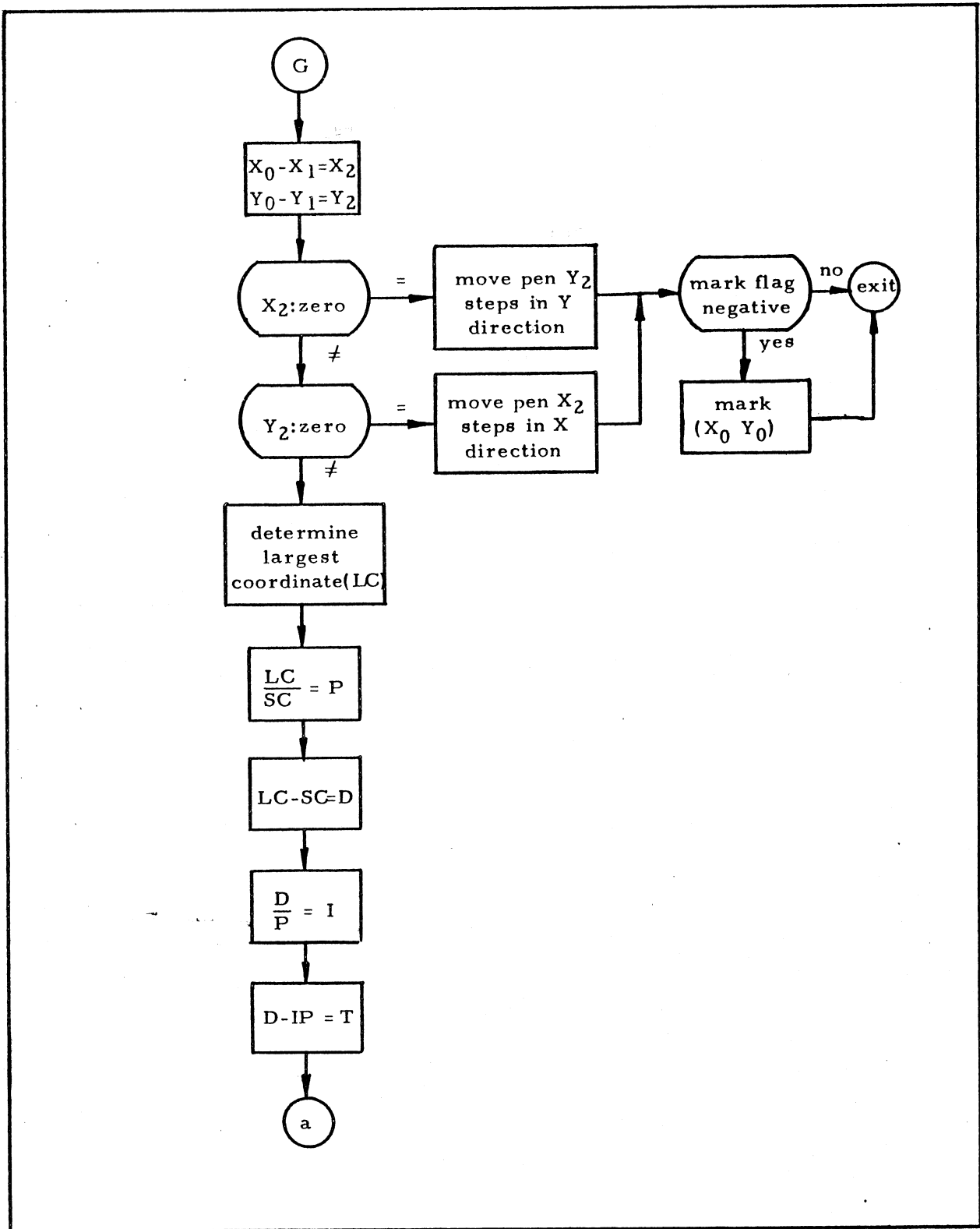Figure 5. Flow Diagram for DR-1 Control Subroutine

(Sheet 1 of 3)

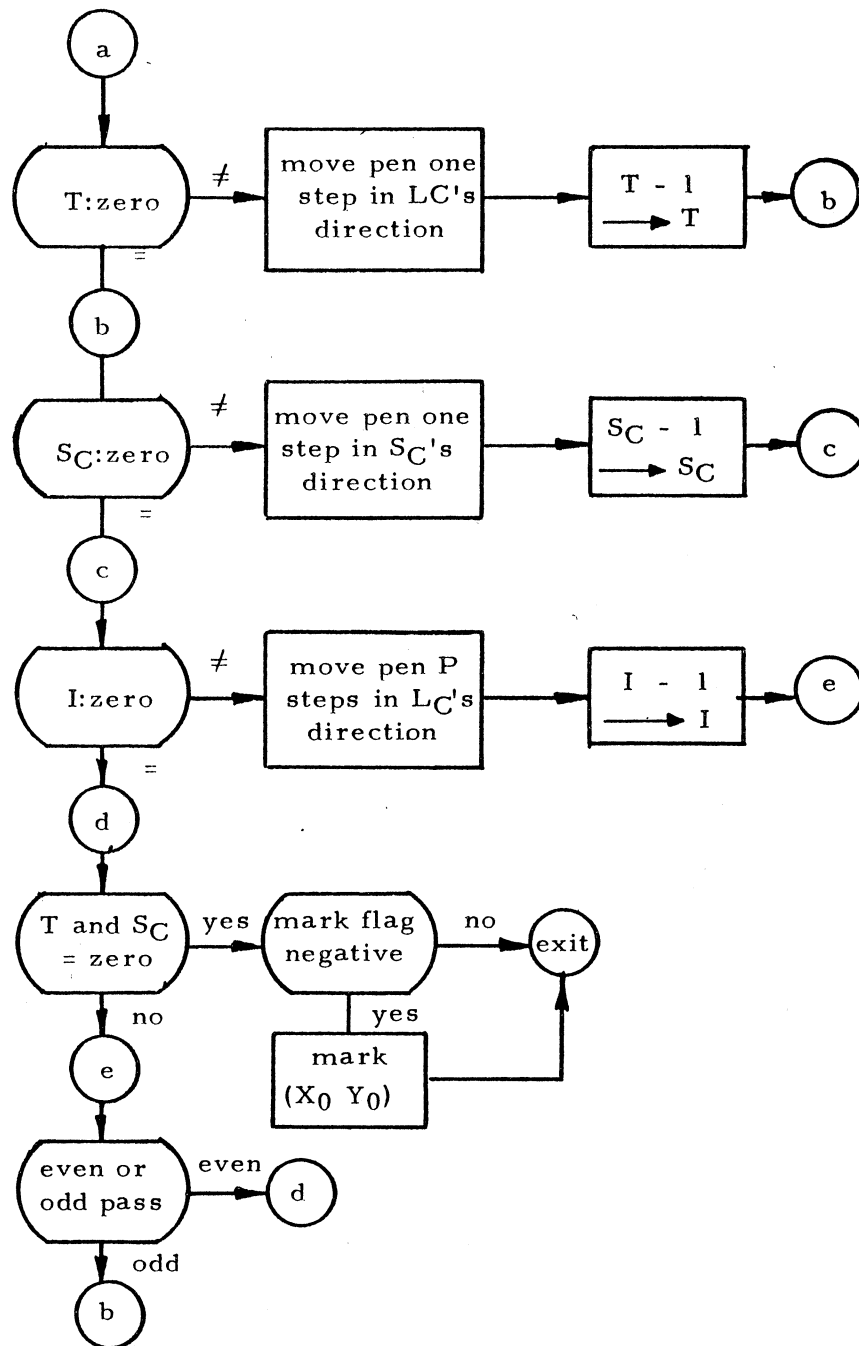Figure 5.   Flow Diagram for DR-1 Control Subroutine

(Sheet 2 of 3)

Figure 5. Flow Diagram for DR-1 Control Subroutine

(Sheet 3 of 3)